# The new Sentinel-1 based global flood monitoring system of the Copernicus Emergency Management Service

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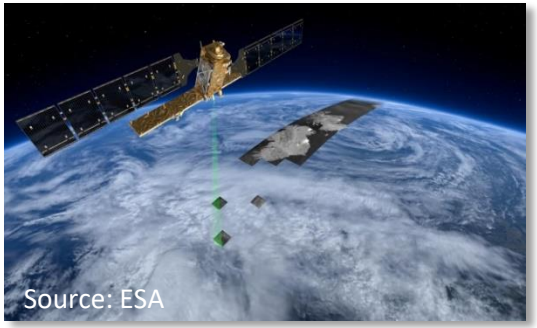
Emergency Management

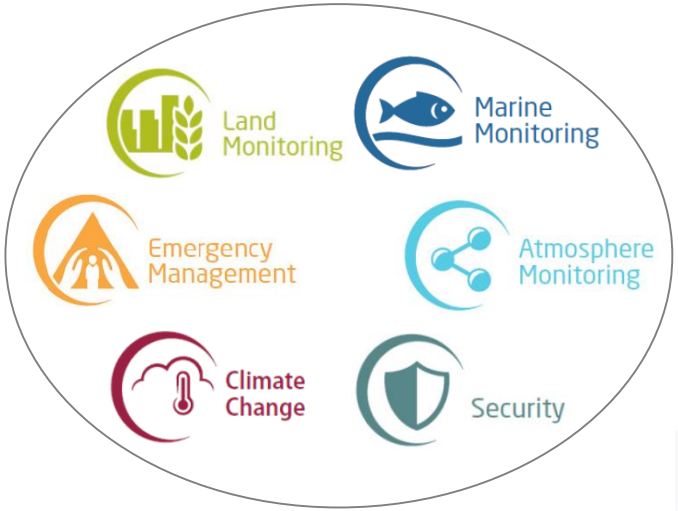
# EU's Earth Observation Programme

Copernicus
Europe's eyes on Earth

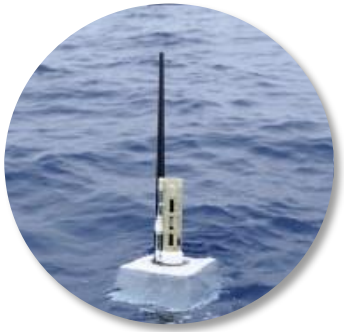
## 6 services use Earth Observation data to deliver …

Satellites: Sentinels & Contributing Missions




In-situ measurements



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# Copernicus Emergency Management Service

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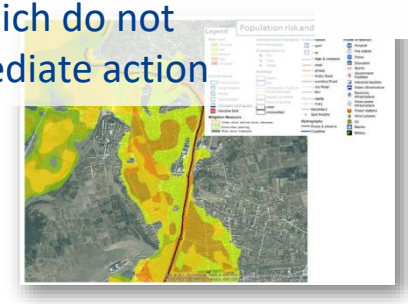
## Rapid Mapping

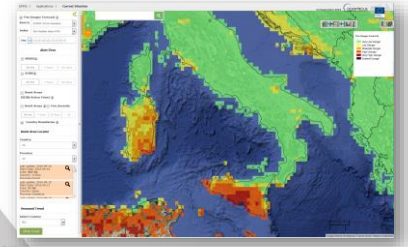
24/7 on-demand and fast provision of geospatial information

## Risk & Recovery Mapping

On-demand geospatial information supporting situations which do not require immediate action

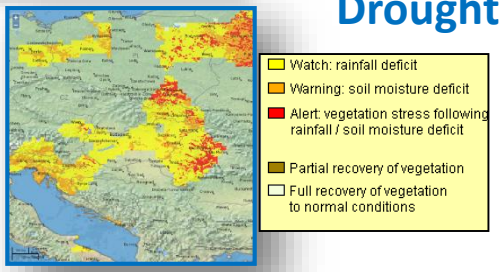



## European Forest Fire Information System (EFFIS)



NRT & historical info on forest fires in the European, Middle Eastern & N-African regions

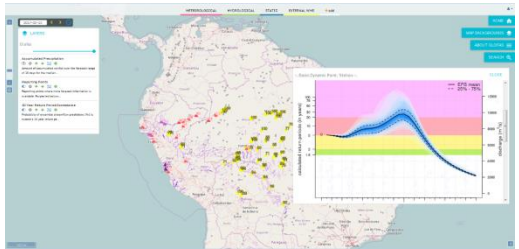
## European & Global Drought Observatory




Drought monitoring and forecasting

## European & Global Flood Awareness System (EFAS & GloFAS)

Flood monitoring and forecasting



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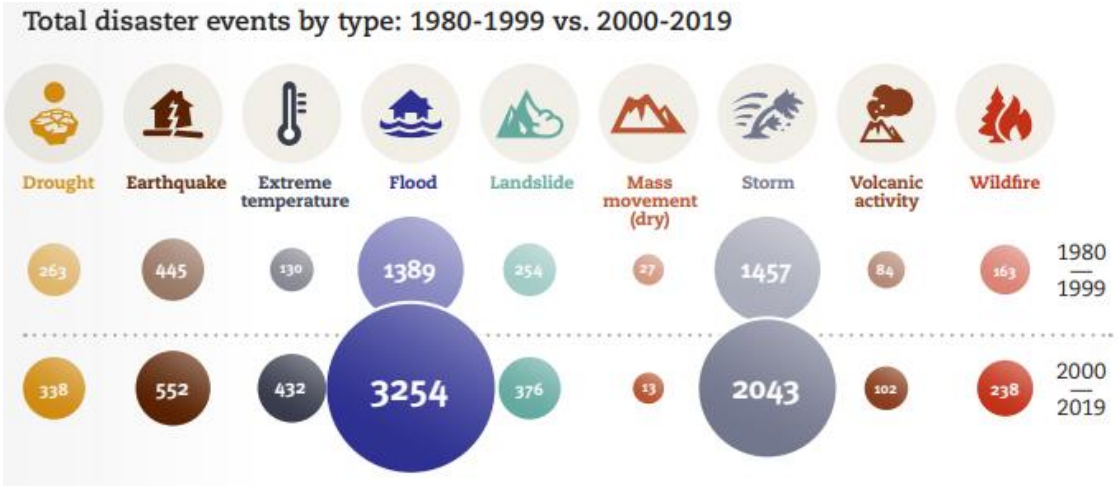
# New global flood monitoring product




*Source: CRED 2020*

**User requirements:**

- **Timeliness**: better response planning
- **Frequent updates/continuous monitoring**: adapt measures depending on the evolution of the flood
- **Resolution**: needs to be adequate for impact assessment
- **Historic data**: improved prevention planning
- **Access**: as diverse as possible to account for all user needs

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# CEMS – automatic global flood monitoring

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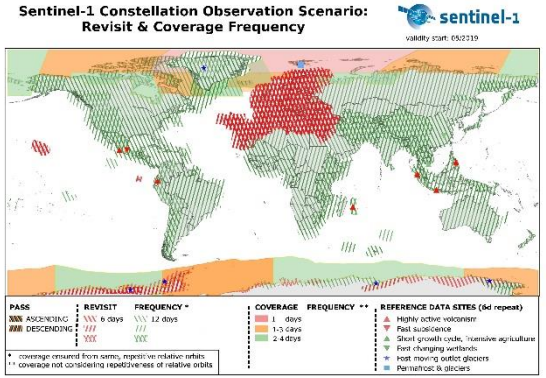
## Sentinel-1 based:

- SAR enables **all day and all weather** flood monitoring
- High **spatial resolution of 20 m**
- High **revisit frequency**: Europe **~ 1 – 3 days** World **~ 3 – 14 days** (to be further increased with Sentinel-1 C)

## Automatic:

- **High timeliness** of the product – **less than 8 hours** between sensing and product delivery
- **Continuous monitoring** for large areas




*Source: ESA*

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# CEMS – automatic global flood monitoring

| **Algorithm LIST** (Chini et al., 2017) | **Algorithm DLR** (Martinis et al. 2015) | **Algorithm TU Wien** (Cao et al., under prep.) |
|---|---|---|
| Hierarchical split-based approach enabling re-calibration of parameters in NRT based on most recent pair of S-1 images | Fuzzy logic-based approach enabling a post classification and region growing taking advantage of topography-derived indices in addition to SAR backscatter | Exploiting per-pixel full Sentinel-1 signal history in data cube (backscatter probability distribution); enabling a very fast and scalable production through pre-computed global parameters at high quality |

**Requirements:**

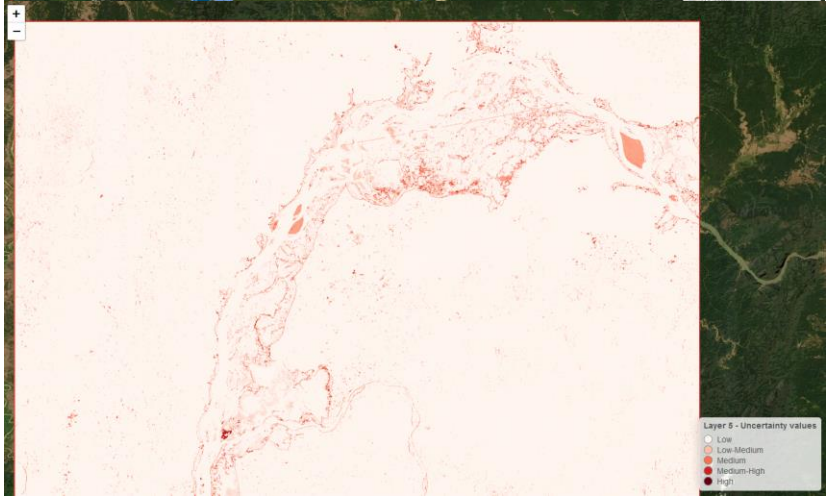
- **High algorithm maturity** due to application in a fully automated environment and in a wide variety of settings

# CEMS – automatic global flood monitoring

Emergency Management

**Products:**

- Observed flood extent
- Reference water mask
  - Seasonal/permanent
  - based on historical Sentinel-1 time-series
- Ensemble uncertainty
- Advisory flags (snow, ice, frost, dry soil, wind)
- Exclusion layer (urban, dense vegetation, radar shadows, low backscatter)

# CEMS – automatic global flood monitoring

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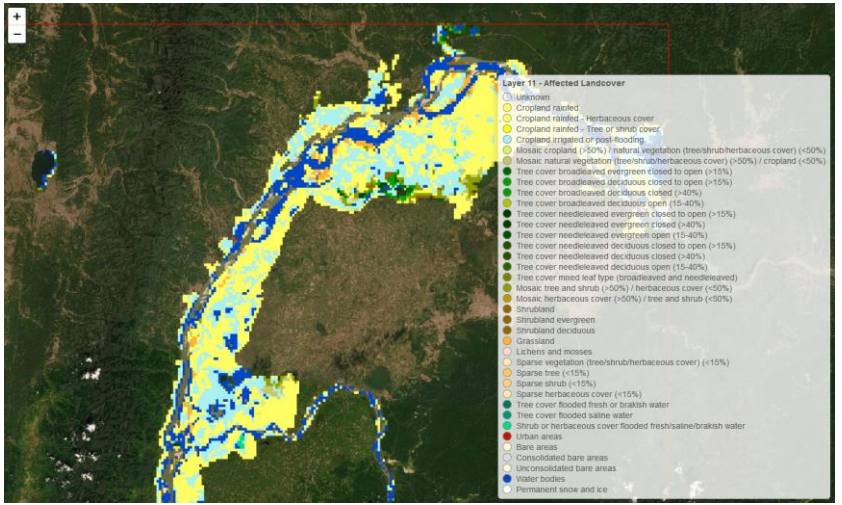
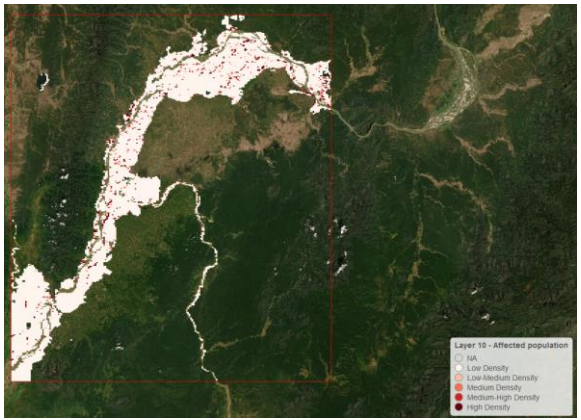
## Products:

- Impact information
  - Landuse (GlobCover)
  - Population (Global Human Settlement Layer)
- Sentinel 1 metadata - footprint - schedule







# CEMS – automatic global flood monitoring

Emergency Management

## Product access:

- Free and open
- Visualization:
  - EFAS and GloFAS web interfaces
  - Web services (WMS)
  - Ready-to-print maps
- Data access: API

## Planned implementation timeline:

- Start: November 2020
- Operational: August/September 2021

EODC Earth Observation Data Centre for Water Resources Monitoring GmbH

GeoVille Information Systems and Data Processing GmbH

Technische Universität Wien

Deutsches Zentrum für Luft- und Raumfahrt EV

Luxembourg Institute of Science and Technology

Centro Internazionale in Monitoraggio Ambientale – Fondazione CIMA

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# Thank you!

# Questions?